Radioactivity in the Risø District January-June 2013

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DTU Nutech Report

Sven P. Nielsen, Kasper G. Andersson and Arne Miller
DTU-Nutech-R-0006(EN)
December 2013

DTU Nutech
Center for Nuclear Technologies

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Title: Radioactivity in the Risø District January-June 2013
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Abstract (max. 2000 char.): The environmental surveillance of the Risø environment was continued in January-June 2013. The mean concentrations in air were: 0.55±0.51 μBq m^{-3} of ^{137}Cs, 2.96±1.18 mBq m^{-3} of ^{7}Be and 0.26±0.25 mBq m^{-3} of ^{210}Pb (±1 S.D.; N = 26). The depositions by precipitation at Risø in the first half of 2013 were: 0.074 Bq m^{-2} of ^{137}Cs, 425 Bq m^{-2} of ^{7}Be, 35.0 Bq m^{-2} of ^{210}Pb and < 0.7 kBq m^{-2} of ^{3}H. The average background dose rate (TLD) at Risø (Zone I) was measured as 136 nSv h^{-1} compared with 119 ± 16 nSv h^{-1} (±1 S.D.; N = 4) in the four zones around Risø.

TLD results for the period November 2012 – April 2013 are significantly higher than results for the periods before and after this one. No errors could be identified in raw data or calculations. It should be noted that the results for the following period (May-October 2013) are already available and generally show no increase in the levels compared with previous years. It is therefore assumed that the increase in dose values as shown in this report are related to an error on the TL measurement instrument that was found immediately after the measurements.

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Table 1. Radionuclides in ground level air collected at Risø (cf. Figs. 1, 1.1 and 1.2), January - June 2013. (Unit: μBq m^{-3})

Date		^{7}Be	^{137}Cs	^{210}Pb
31-Dec-13 –	07-Jan-13	1367	0.152	49
07-Jan-13 –	14-Jan-13	2034	0.668	243
14-Jan-13 –	21-Jan-13	4577	1.680	765
21-Jan-13 –	28-Jan-13	6111	1.272	535
28-Jan-13 –	04-Feb-13	4766	0.463	86
04-Feb-13 –	11-Feb-13	3610	0.834	276
11-Feb-13 –	18-Feb-13	4097	2.158	1088
18-Feb-13 –	25-Feb-13	4924	1.236	691
25-Feb-13 –	04-Mar-13	3269	0.625	250
04-Mar-13 –	11-Mar-13	3678	0.378	202
11-Mar-13 –	18-Mar-13	1886	0.435	157
18-Mar-13 –	25-Mar-13	2765	0.330	216
25-Mar-13 –	02-Apr-13	2509	0.657	150
02-Apr-13 –	08-Apr-13	3044	0.403	168
08-Apr-13 –	15-Apr-13	1759	0.498	188
15-Apr-13 –	22-Apr-13	2474	0.479	105
22-Apr-13 –	29-Apr-13	2269	0.136	106
29-Apr-13 –	06-May-13	2763	0.225	121
06-May-13 –	13-May-13	3296	0.191	181
13-May-13 –	21-May-13	3507	0.477	292
21-May-13 –	27-May-13	2060	0.230	134
27-May-13 –	03-Jun-13	1981	0.259	181
03-Jun-13 –	10-Jun-13	2172	0.208	110
10-Jun-13 –	17-Jun-13	2083	0.089	112
17-Jun-13 –	24-Jun-13	2234	0.093	151
24-Jun-13 –	02-Jul-13	1718	0.112	63
Mean		2959	0.550	255
SD		1176	0.513	246

Table 2.1. Radionuclides in precipitation in the 10 m^2 rain collector at Risø (cf. Fig. 1), January - June 2013. (Unit: Bq m^{-3})

Month	^{7}Be	^{137}Cs	^{210}Pb
January	1313	0.183	129
February	2172	0.241	188
March	1294	0.405	156
April	2075	0.655	163
May	2744	0.477	242
June	3012	0.456	216

Table 2.2. Radionuclides in precipitation in the 10 m^2 rain collector at Risø (cf. Fig. 1), January - June 2013. (Unit: Bq m^{-2})

Month	Precipitation (m)	^{7}Be	^{137}Cs	^{210}Pb
January	0.024	31.5	0.0044	3.1
February	0.021	45.6	0.0051	4.0
March	0.012	15.5	0.0049	1.9
April	0.019	39.4	0.0124	3.1
May	0.044	120.7	0.0210	10.7
June	0.057	171.7	0.0260	12.3
Sum	0.177	424.5	0.0737	35.0

Table 2.3. Tritium in precipitation collected at Risø (cf. Figs. 1, 2.3.1 and 2.3.2). January - June 2013. (Unit: kBq m^{-3})

Month	1 m^2 rain collector*	10 m^2 rain collector*
January	4.3	< 3.3
February	3.2	< 3.3
March	< 3.3	< 3.3
April	< 3.3	< 3.3
May	< 3.3	< 3.3
June	< 3.3	< 3.3

Double determinations*.

Table 2.4. Tritium in precipitation collected at Risø (cf. Fig. 1). January - June 2013. (Unit: kBq m^{-2})

Month	Precipitation (m)	1 m^2 rain collector	10 m^2 rain collector
January	0.024	0.103	< 0.079
February	0.021	0.067	< 0.069
March	0.012	< 0.039	< 0.040
April	0.019	< 0.063	< 0.063
May	0.044	< 0.145	< 0.145
June	0.057	< 0.188	< 0.188
Sum	0.177	< 0.606	< 0.584

Table 3.1. Radionuclides in sediment samples collected at Bolund in Roskilde Fjord.(cf. Fig. 3.1) January - June 2013. (Unit: Bq kg^{-1} dry)

No samples in this period.

Table 4.1. Radionuclides in seawater collected in Roskilde Fjord (cf. Fig. 4.1) January - June 2013. (Unit: Bq m^{-3})

No samples in this period.

Table 4.2. Tritium in seawater collected in Roskilde Fjord (Risø pier) (cf. Fig. 4.2) January - June 2013.

Month	kBq m^{-3}
March	< 3.3 *
June	< 3.3 *
* Double determinations	

Table 5.1. Radionuclides in grass (snow) collected at Risø (near the Waste Treatment Station (cf. Fig. 1)), January - June 2013. (**Measured on bulked ash samples)*

Week no. or month	Date	K (g kg^{-1} fresh)	^{137}Cs (Bq kg^{-1} fresh)	^{137}Cs (Bq m^{-2})
1	1 January*	<0.1	<0.2	
3	14 January*	<0.1	<0.2	
5	28 January*	<0.1	<0.3	
7	11 February*	<0.1	<0.2	
9	26 February*	<0.1	<0.2	
11	11 March	6.6	1.1	
13	25 March*	<0.2	<0.3	
15	8 April	6.4	<2.2	
17	22 April	5.0	<2.5	
19	6 May	6.7	<0.5	
21	21 May	5.5	<0.4	
23	3 June	5.1	<0.5	
25	17 June	4.6	<0.5	
**January			-	-
**February			-	-
**March			0.436	0.049
**April			0.589	0.029
**May			0.044	0.011
**June			0.053	0.028

Table 5.2. Radionuclides in Fucus vesiculosus collected at Bolund in Roskilde Fjord. January - June 2013. (Unit: Bq kg^{-1} dry)

No samples in this period.

Table 7.1. Waste water collected at Risø (cf. Fig. 1), January - June 2013.

Week number	eqv. mg KCl l^{-1}	^{137}Cs (Bq m^{-3})	^{131}I (Bq m^{-3})	^{226}Ra (Bq m^{-3})
1	44	<83	<175	<239
2	35	<68	<55	<116
3	74	<105	<106	<198
4	115	<104	<104	<200
5	87	<58	<44	<109
6	79	<109	<117	<229
7	61	<107	<115	<231
8	57	<115	<124	<222
9	88	<103	<106	<209
10	118	<109	<106	<215
11	147	<105	<119	<215
12	163	<114	<121	<226
13	133	<107	<120	<226
14	124	<109	<118	<213
15	127	<129	<134	<262
16	132	<131	<139	<271
17	146	<84	<75	<154
18	149	<117	<124	<225
19	163	<107	<109	<219
20	216	<126	<140	611
21	190	<105	<10	203
22	166	<113	<119	445
23	177	<104	<114	203
24	131	<118	<120	688
25	117	<114	<126	<229
26	117	<106	<107	<205
Mean	121.4	< 105	<109	<252
SD	45.7			

Table 8.1. Background dose rates around the border of Risø (cf. Fig. 8.1) measured with thermoluminescence dosimeters (TLD) in the period November 2012 – April 2013. (Results are normalized to nSv h^{-1})

Location	nSv h^{-1}
1	191
2	114
3	93
4	92
5	119
6	129
Mean	123

Note regarding Table 8.1 and 8.2

TLD results for the period November 2012 – April 2013 are significantly higher than results for the periods before and after this one. No errors could be identified in raw data or calculations. It should be noted that the results for the following period (May-October 2013) are already available and generally show no increase in the levels compared with previous years. It is therefore assumed that the increase in dose values as shown in this report are related to an error on the TL measurement instrument that was found immediately after the measurements.

Table 8.2. Background dose rates around Risø (cf. Fig. 8.2 and Fig. 1) measured with thermoluminescence dosimeters (TLD) in the period November 2012– April 2013. (Results are normalized to nSv h^{-1}),

Risø zone	Location	nSv h^{-1}
I	1	108
I	2	105
I	3	133
I	4	234
I	5	102
Mean		136
II	P1	165
II	P2	110
II	P3	124
II	P4	153
Mean		137
III	P1	84
III	P2	202
III	P3	88
Mean		125
IV	P1	89
IV	P2	83
IV	P3	126
IV	P4	115
IV	P5	94
IV	P6	90
IV	P7	111
Mean		101
V	P1	130
V	P2	99
V	P3	36
V	P4	120
V	P5	155
V	P6	104
V	P7	160
V	P8	125
V	P9	86
V	P10	112
Mean		113

*Table 8.3. Terrestrial dose rates at the Risø zones (cf. Fig. 8.2 and Fig. 1) January - June 2013. Measured with a NaI(Tl) detector. (Unit: nSv h^{-1})**

No measurements in this period.

*Starting 2012, levels in Risø zones I and II are reported biannually, and levels in zones III, IV and V are reported annually (measurements in autumn).

Fig. 1. Locations for measurements of gamma-background radiation Zone I and II (cf. Tables 8.2 and 8.3)

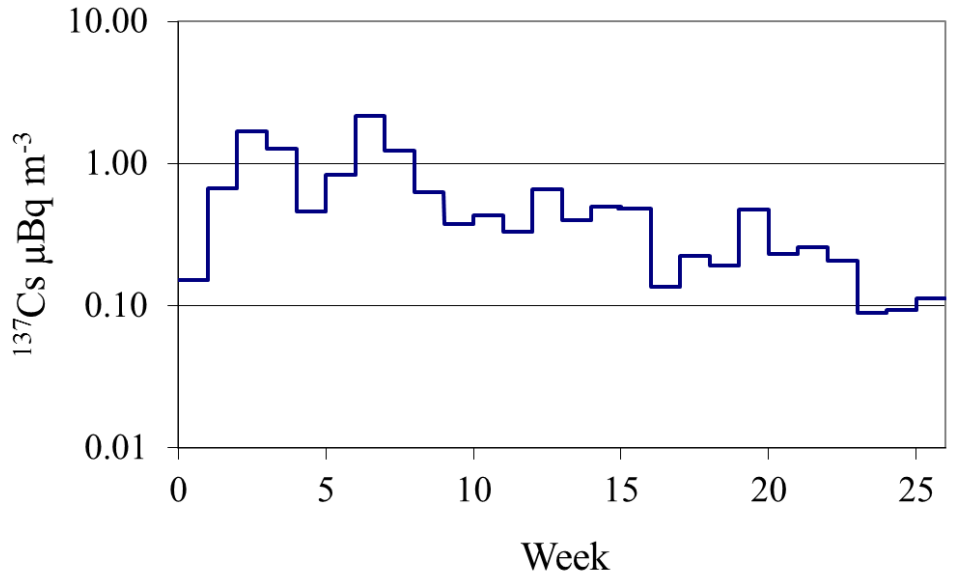

Fig. 1.1. Caesium-137 in ground level air collected at Risø in January-June 2013. (Unit: µBq m^{-3})

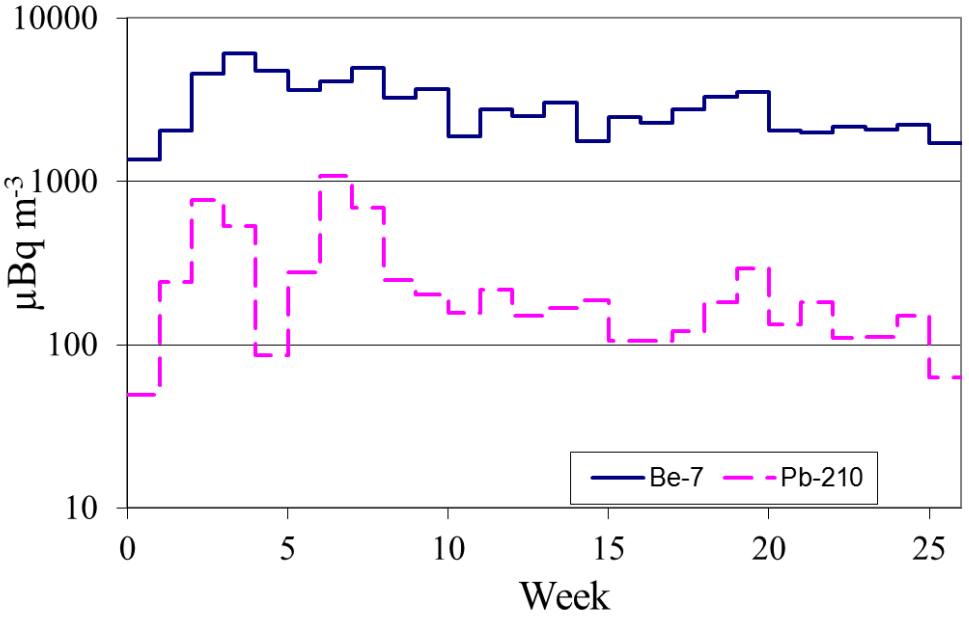

Fig. 1.2. Beryllium-7 and Lead-210 in ground level air collected at Risø in January-June 2013. (Unit: µBq m^{-3})

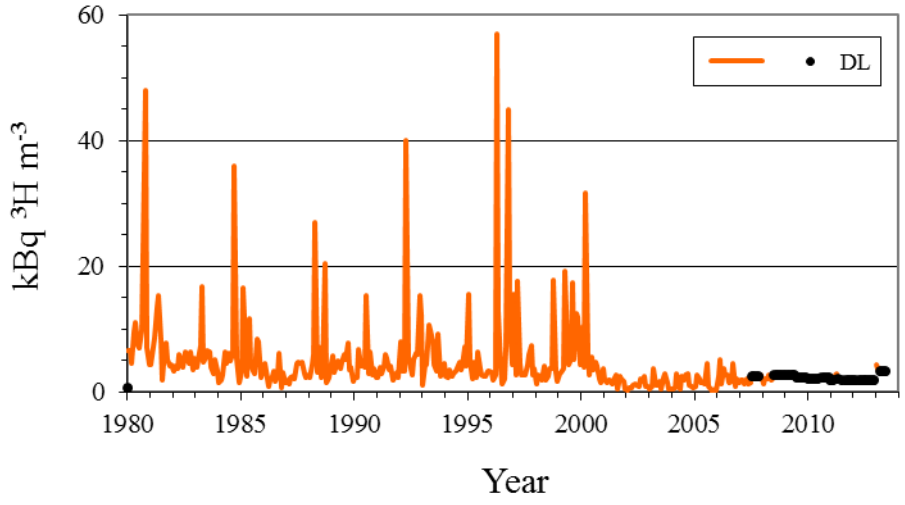

Fig. 2.3.1. Tritium in precipitation collected at Risø (1 m^2 rain collector) 1980 - 2013. (Unit: kBq m^{-3}; DL = detection limit)

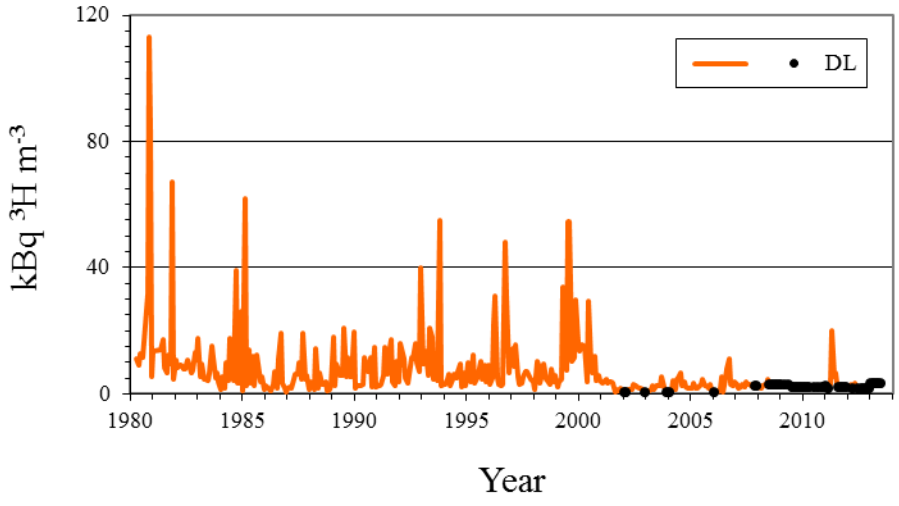

Fig. 2.3.2. Tritium in precipitation collected at Risø (10 m^2 rain collector) 1980 - 2013. (Unit: kBq m^{-3}; DL = detection limit)

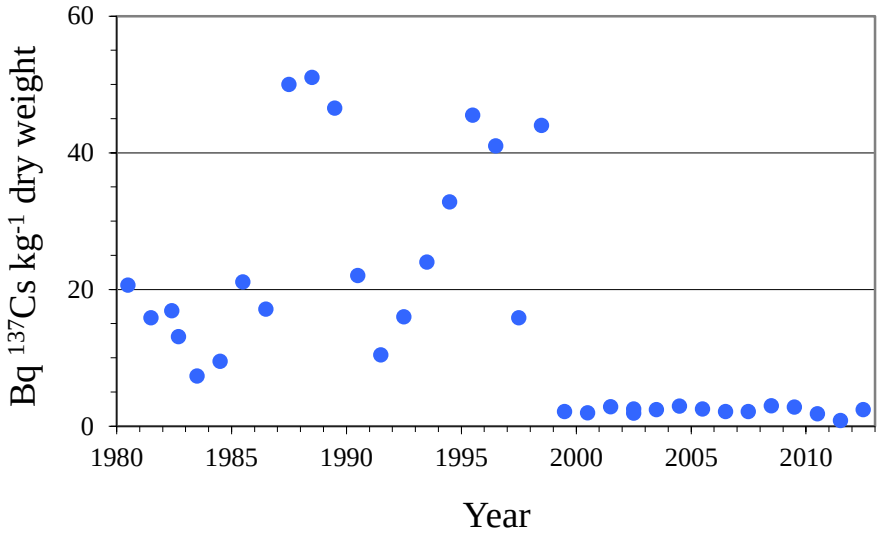

Fig. 3.1. Caesium–137 in sediment samples collected at Bolund in Roskilde Fjord. 1980 – 2013. (Unit: Bq kg^{-1} dry matter)

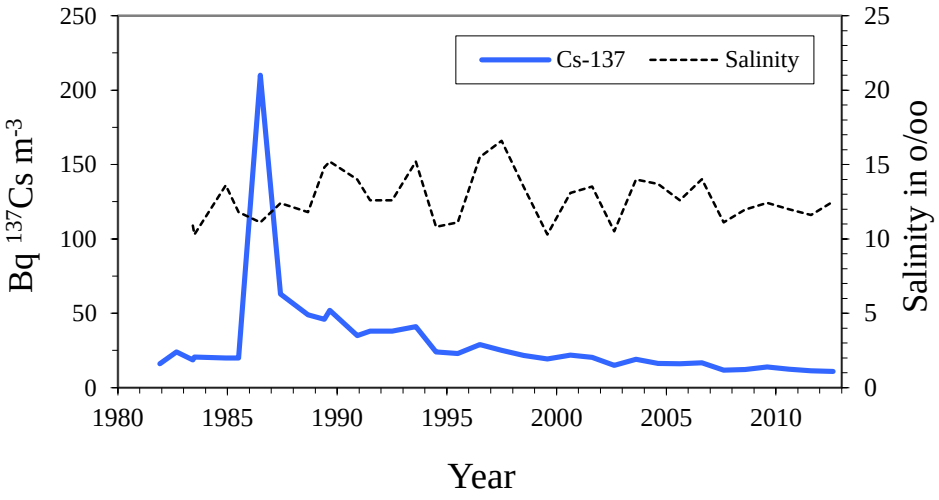

Fig. 4.1. Caesium–137 in seawater collected in Roskilde Fjord 1980 - 2013. (Unit: Bq m^{-3})

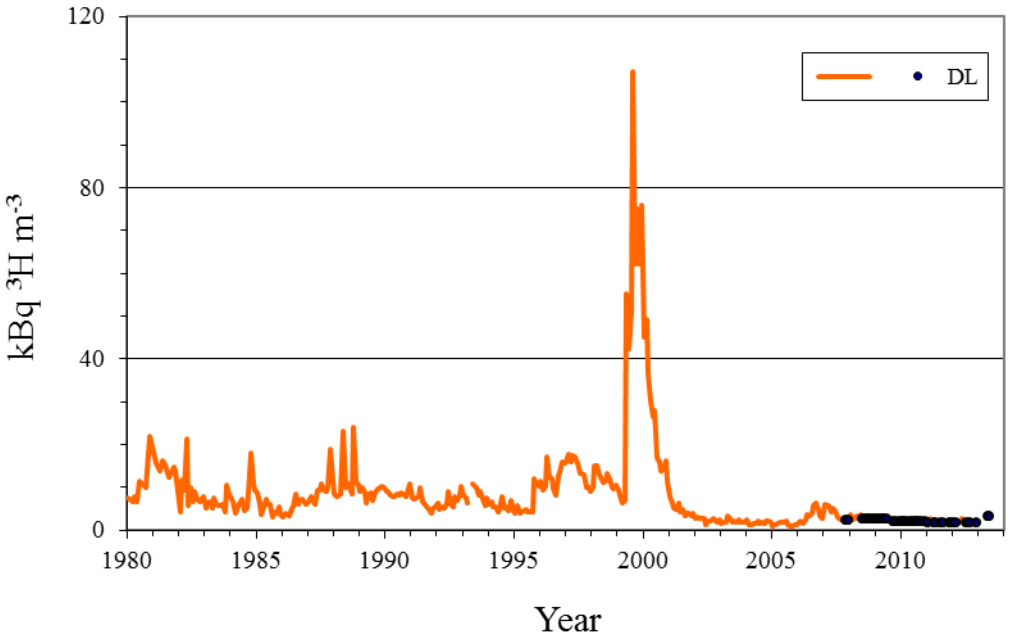

Fig. 4.2. Tritium in seawater collected in Roskilde Fjord 1980 - 2013. (Unit: kBq m^{-3}; DL = detection limit)

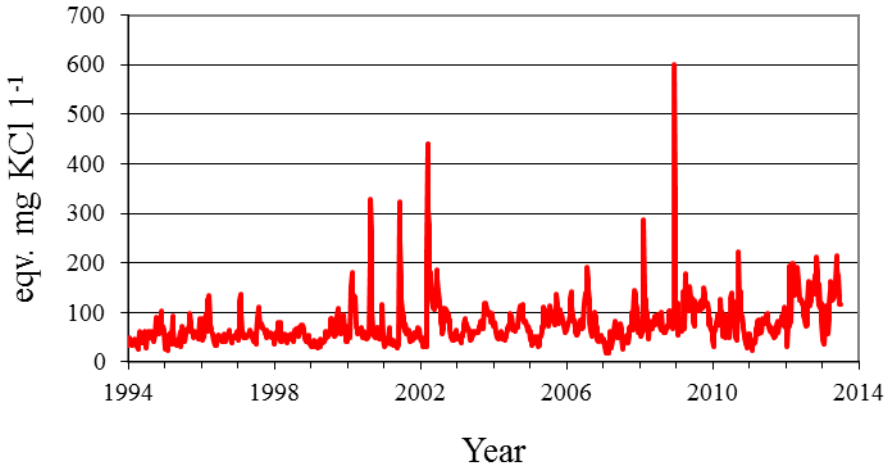

Fig. 7.1. Total-beta radioactivity in waste water collected at Risø 1994 - 2013. (Unit: eqv. mg KCl l^{-1})

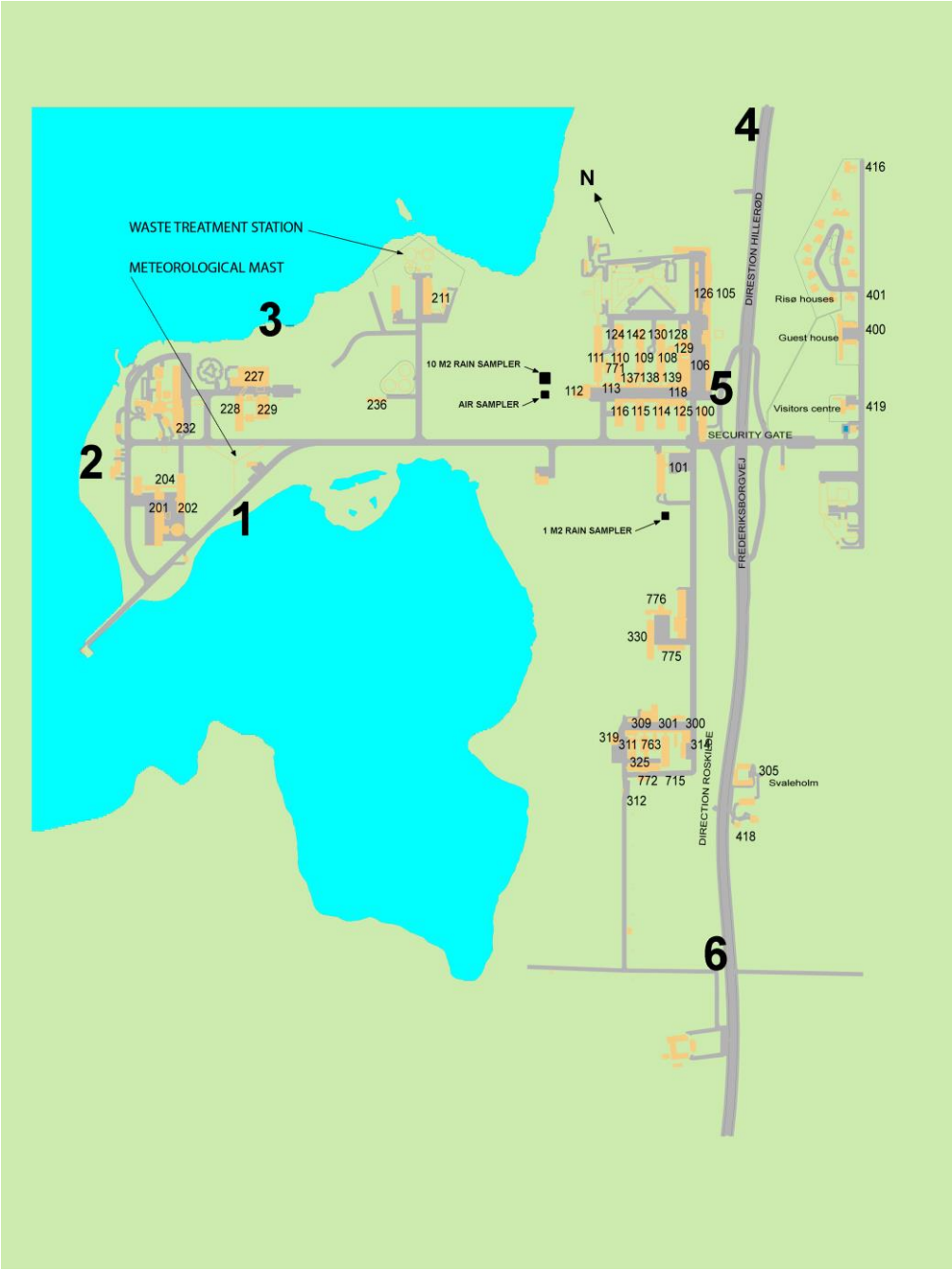

Fig. 8.1. Locations (1-6) for TLD measurements around the border of Risø (cf. Table 8.1).

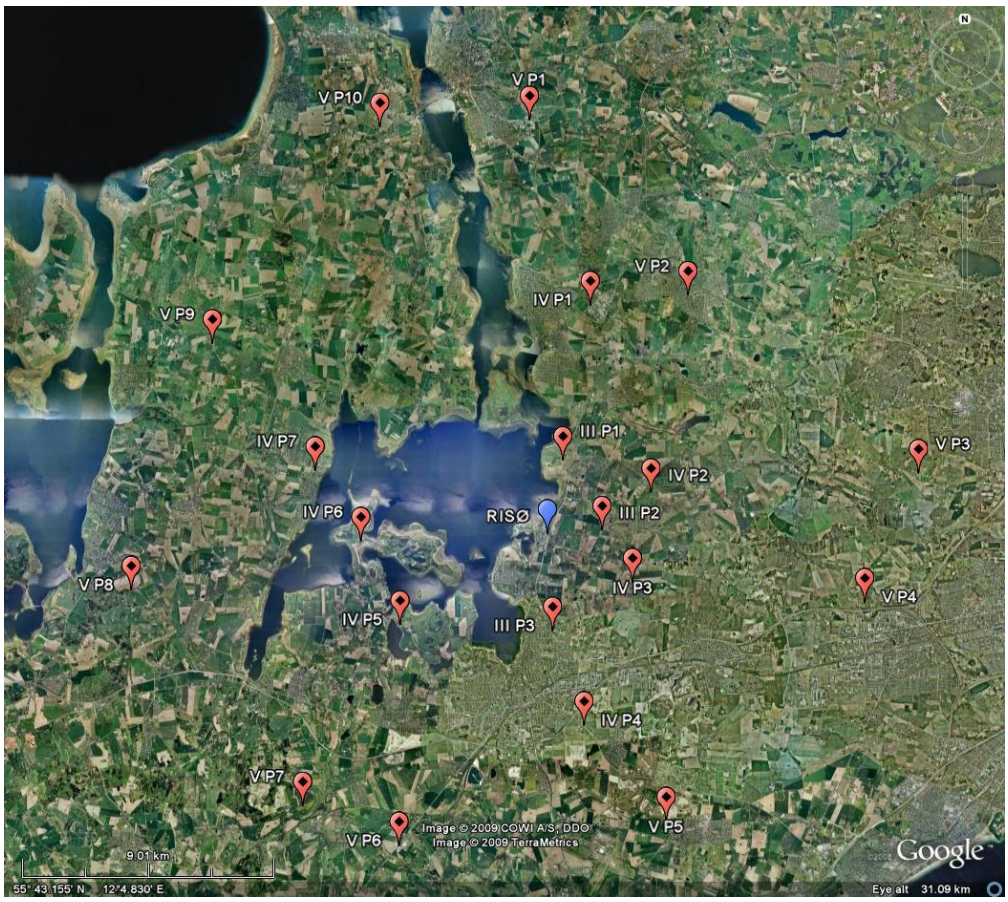

Fig. 8.2. Locations for measurements of background radiation around Risø in Zones III, IV and V.

Center for Nuclear Technologies is Denmark's national competency center for nuclear technology. With roots in research in the peaceful use of nuclear power, DTU Nutech works with the applications of ionizing radiation and radioactive substances for the benefit of society.

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